## TABLE OF CONTENTS

A NOTE FROM THE COMMITTEE.......................................................................................................................... 3
WHO CREATED THE PINewood DERBY?.................................................................................................................. 4
WHAT DO SCOUTS LEARN FROM PINewood DERBY?............................................................................................ 6
THE THREE PRINCIPAL LESSONS OF THE PINewood DERBY............................................................................ 6
HOW DOES A PINewood DERBY RACE WORK?....................................................................................................... 7
  RACE SCHEDULE AND METHODS...................................................................................................................... 7
  POINTS SCORING SYSTEM..................................................................................................................................... 8
  OFFICIAL TIEBREAKER CALCULATIONS.................................................................................................................. 9
RULES REGARDING SITUATIONS WHERE SOMETHING CAN (AND OFTEN DOES) GOES WRONG....................... 9
CONSENT TO BE PHOTOGRAPHED....................................................................................................................... 10
WHAT DO I DO WITH MY CAR ON RACE DAY?..................................................................................................... 11
  REGISTRATION.................................................................................................................................................... 11
  PWD CAR IDENTIFICATION................................................................................................................................... 11
  PHYSICAL DIMENSIONS........................................................................................................................................ 11
  CONSTRUCTION MATERIALS INSPECTION........................................................................................................... 11
  FINAL WEIGH-IN AND CHECK-IN.......................................................................................................................... 12
  IMPOUND AREA.................................................................................................................................................... 12
  VOLUNTEERS NEEDED.......................................................................................................................................... 12
HOW DO I BUILD A DERBY CAR?.......................................................................................................................... 13
  BUYING A 100% PREMADE FINISHED CAR OFF THE INTERNET OR OTHER SOURCE................................. 13
  THE “CORE” OF YOUR CAR.................................................................................................................................. 13
  DESIGNING A NARROW FRONT CAR.................................................................................................................... 15
  CARS WITH A HIGH NOSE DESIGN..................................................................................................................... 15
  AXLES, AXLES, AXLES.......................................................................................................................................... 16
    SOURCE FOR AXLES........................................................................................................................................... 16
    AXLE LOCATION................................................................................................................................................... 17
    AXLE LUBRICATION.............................................................................................................................................. 17
  WHEELS GO ROUND AND ROUND.......................................................................................................................... 18
  COMPARISON OF NEW WHEELS WITH OLD WHEELS.......................................................................................... 19
  WHEEL MANUFACTURING MOLD COMPARISON..................................................................................................... 20
WHEELS RULES 2013.................................................................................................................................................. 22
  2013 APPROVED CONSTRUCTION CHART............................................................................................................. 23
WHAT CAN I DO TO MAKE MY WHEELS BETTER?.................................................................................................... 24
WHAT CAN I DO TO MAKE MY AXLES BETTER?...................................................................................................... 25
  HOW TO POLISH YOUR AXLES............................................................................................................................ 25
WHAT CAN I DO TO MAKE MY DERBY CAR FASTER?.............................................................................................. 26
WHERE CAN I LEARN MORE ABOUT BUILDING A GREAT DERBY CAR?............................................................... 27
CONDUCT OF SCOUTS AND THEIR GUESTS............................................................................................................. 28
PACK RESPONSIBILITIES.......................................................................................................................................... 28
REGISTRATION INSTRUCTIONS FOR THE SHELTER ROCK PINewood DERBY......................................................... 31
DISTRICT PINewood DERBY RACE SCHEDULE....................................................................................................... 32
SHELTER ROCK DISTRICT PINewood DERBY REGISTRATION FORM........................................................................ 33
A NOTE FROM THE COMMITTEE:

Contained within this document are the makings of a great event for our District. Ultimately, that success or failure will come as a direct result of the involvement of as many of our dedicated Leaders and parents as possible – shared leadership and shared responsibility. To that end, we will be conducting an ongoing development process of these rules and standards for the benefit of ALL units. This process has lasted the entire month of November, and culminates in the final rules listed within this document and approved by all Districts. We would like to acknowledge the Seminoles Springs District of the CFC Council for the framework and format of this Event Guide. Their help and support was greatly appreciated.

THE PRIMARY FOCUS OF THIS EVENT GUIDE IS AS FOLLOWS:

1. Provide the FIRST TIME Derby Organizer with a framework for conducting a fun and fair event.
2. Establish a fair, consistent baseline for construction and preparation of PWD cars.
3. Provide consistency across the board from Pack Level races through District Level races, with the intent of insuring that the PWD car that is built within the rules for a Pack Race is able to qualify for additional events without modification of the PWD car.
4. Provide Shelter Rock District with the ongoing reputation of being a top shelf program, worthy of the recognition and replication of our success within the region and nationally.

It is the desire and goal of the PWD Committee to have 100% participation from all Packs, and for the “best of the best” to come out swinging in defense of their Pack. The all aluminum PWD Track to be used for this event is in its second year of operation, and has been continually fine tuned to as close to “perfect lanes” as possible. The Pit Crew can always use a few additions to share the load, and Registration / Inspection will always require experienced eyes to insure fairness.

So... your mission.... Should you choose to accept it.... is to contribute to the success of the Shelter Rock District Pinewood Derby! Endorse the use of these rules at your Pack Event, and insure that all Scouts within your Pack know there are Pinewood Derby Events to participate in at the Pack, and District Levels. Let us insure that all of the Scouts who desire to participate have the opportunity to participate.

NOTE: The Race Day methods and procedures described are specific to Shelter Rock District’s PWD. They are not the ONLY way to conduct a PWD Event, and you should check with your Pack PWD Committee to learn how that event will be conducted. Any Packs wishing to use any of the race day materials and methods described are welcome to pull those documents from the official 2012 Derby link (TBD) on the Theodore Council Website (www.trcbsa.org).
WHO CREATED THE PINewood DERBY?

This document, and the event upon which it is based, is dedicated to the hundreds of thousands of former, present, and future Scouts who have participated in Pinewood Derby. As we mourn the passing of Pinewood Derby Creator Don Murphy in 2008, I felt it was appropriate to start with a few words from the man himself:

"I wanted to devise a wholesome, constructive activity that would foster a closer father-son relationship and promote craftsmanship and good sportsmanship through competition."

Don Murphy’s idea, as stated in his quote above, was his idea for starting the Pinewood Derby. It began in the Management Club at a company called North American Aviation where he worked in 1953. Mr. Murphy wanted to create a Cub Scout activity he could do with his son. The idea of racing miniature cars came to him while thinking of his company sponsored Soap Box Derby races.

"I’d made models of airplanes, cars, boats, and any number of other structures and remembered the pleasure I got out of doing it," he said.
He asked the Management Club at North American Aviation to sponsor a miniature racing event for his Cub Scout Pack that he had named a "pinewood derby." The club agreed to pay for the wood and other materials.

Murphy designed a miniature car that could be carved out of soft pinewood and wrote the rules. "Pack 280C had seven dens and den mothers," remembers Murphy, "and totaled 55 Cub Scouts at the time. Originally the block of wood in the kit was carved down in the forward third to a kind of cockpit. We put the wood, wheels, and nails into a brown paper sack with an assigned number. Some Cub Scout fathers built a 31-foot race ramp with two lanes and a battery-run finish line made from doorbells. Light bulbs would identify the winner."

The derby was an instant success and for a time was copied, with the Management Club's permission, by the Los Angeles County Department of Recreation. Then word reached the national director of Cub Scouting Service, O. W. (Bud) Bennett, who wrote Murphy:

"We believe you have an excellent idea, and we are most anxious to make your material available to the Cub Scouts of America."

Within the year the pinewood derby was adopted for use in all Cub Scout Packs. In its October 1954 issue, Boys' Life publicized the event and offered plans for the track and a car, which featured "four wheels, four nails, and three blocks of wood".

And the rest, as they say, is History.....
WHAT DO SCOUTS LEARN FROM PINewood DERBY?

The Pinewood Derby is a parent-son project. Please feel free to give guidance and assistance as your Scout builds his Pinewood Derby car. This is a chance for your son to be part of a team and to enjoy the spirit of friendly competition with his peers. This project and event is also an opportunity for your Cub Scout to enjoy the satisfaction of building his own car from the resources provided.

A special note to all parents and Scouts: While everyone will be trying to win, it’s always a good idea to start out by remembering the Cub Scout Motto “Do Your Best”, and some of the basic ideas behind good sportsmanship as they relate to the Pinewood Derby.

THE THREE PRINCIPAL LESSONS OF THE Pinewood DERBY:

1) Scouts learn the design and craft skills necessary to build a car.
2) Scouts learn the physics of car-building techniques (within the established rules) needed to compete in the Derby.
3) Scouts learn the appropriate personal conduct while participating, winning, and NOT winning in the Pinewood Derby (this is called sportsmanship).

The first thing to remember about sportsmanship is that everyone’s skills are different. You may be good at something like singing or drawing, but not as good at something else like basketball or computers. Parents have different skill levels, too. This doesn’t mean that you are a good person one time and not good another time. You can always be a good person, whether or not you have good car-building skills. Remember, you and your friends are individuals first and racers second. This idea is often called having respect for others.

The second thing to remember is to follow the rules. Without rules, there would be no Pinewood Derby. You will never know if you are really good at doing something unless you follow the rules. This is often called being honest.

The third thing to remember about good sportsmanship is that there are winners and non-winners. You accept this when you choose to compete. There may be times when you win and feel happy, and times when you lose and feel unhappy. Being a winner is easy, and losing is sometimes hard. If you win, you must not brag or gloat. If you lose, you must not feel jealous or bitter. To be a good sportsman, you must be able to say "I did my best" and be satisfied with the results.
HOW DOES A PINEWOOD DERBY RACE WORK?

RACE SCHEDULE & METHODS (PACK METHODS MAY VARY)

1. Pinewood Derby is a gravity-powered racing activity that involves staging PWD CARS at the top of an inclined, multilane track, and then allowing them to roll freely down the incline and out to the Finish Line.

2. Once Each PWD CAR is registered, inspected, and cleared for racing by the RACE OFFICIALS, it receives a designated RACE NUMBER, which is assigned and entered into the RACE SOFTWARE – GRAND PRIX RACE MANAGER.

3. There is a RACE SCHEDULE, using all of the registered PWD CARS, which is produced by the RACE SOFTWARE – GRAND PRIX RACE MANAGER. The software insures that each PWD CAR races against as many different opponents as possible, insuring the greatest possible diversity in opponents and lane use. This diversity component is called “The Perfect-N”, and for a detailed scientific explanation go to: http://stanpope.net/math.html

4. Each time cars run down the track, it is called a HEAT.

5. Each PWD CAR will race in one of several RACE DIVISIONS, which will be organized by rank:
   - ALL WEBELOS I
   - ALL BEARS
   - ALL WOLVES
   - ALL TIGERS

6. PWD CARS will race in scheduled HEATS until all PWD CARS have raced ONCE ON EVERY LANE OF THE TRACK.

7. The Race Track is equipped with an Electronic Finish Line Device that records the official Finishing Order and the Elapsed Times (ET’s) for each PWD CAR in a given HEAT, accurate to 0.001 seconds.
OFFICIAL SCORING SYSTEM (YOUR PACK METHODS MAY VARY)

- Traditionally, there are three methods for scoring PINEWOOD DERBY Events – Elimination/Brackets, Points Scoring, and Elapsed Times. Most Packs go with either Points Scoring or Elapsed Times and each method has merits and disadvantages.
- Elimination/Brackets Scoring was considered but not chosen, as less competitive cars race only once or twice after considerable anticipation of racing.
- The Points Scoring Method was considered but not chosen. While fair and accurate, it tends to take many more heats and can lead to ties - taking time we can ill afford.
- Times Scoring is the District’s chosen method. It rewards the cars with the fastest elapsed times. It allows for a significant number of heats for each car while not burdening the time budgeted for each rank.
- In the times scoring method, each car will race once in each of the six lanes against those cars in its respective rank division. Yes, that’s six HEATS minimum for each Scout! (More if he makes the GRAND PRIX).
- The worst HEAT (measured by time) of each entrant will be tossed out and ignored.
- The entrant with the lowest cumulative time (best) after all DIVISION HEATS will move on to the GRAND PRIX to determine an overall DISTRICT DERBY CHAMPION.
- The Grand Prix will be made up of 1 Webelo I, 1 Bear, 1 Wolf and 1 Tiger car. Depending on the time, we will either have 1 final race for all the marbles, OR 4 races, running each car in each of the four finals lanes (lowest cumulative time wins). If we go this route, the worst HEAT in the finals races are NOT thrown out.
- Top 3 entries Per Scout Rank in each category is Recognized with a Trophy.
- NOTE: ONE DISADVANTAGE THAT MAY OCCUR (VERY SLIGHT CHANCE): A BOY MAY WIN EVERY HEAT BUT STILL NOT WIN HIS DIVISION – IF HE CONSTANTLY RACES AGAINST THE SLOWEST CARS IN HIS RANK.
- Copies of all race-related data will be made available for public viewing online, or, at least e-mailed to the Packs for distribution.
- If there is a dispute or clarification request of ANY KIND, Inspection Officials will confer and make a decision. An appeal of that decision can only be made to the EVENT CHAIRMAN. The EVENT CHAIRMAN reserves the right to deny the appeal on the basis of the decision of the Inspection Officials, OR may choose to further discuss the matter in an attempt to better resolve the situation. ALL appeals from Inspection Officials to the EVENT CHAIRMAN will be made with the understanding that the person requesting the appeal AGREES to accept the final decision regarding the matter as decided by the EVENT CHAIRMAN. THERE ARE NO APPEALS ONCE THE EVENT CHAIRMAN HAS MADE A DECISION.
- Registration and participation in this event constitutes verbal consent to the rules set forth in these documents, as well as the official rulings of Event Officials on the day of the event.
- The organizers of these events reserve the right to amend, adjust, omit, and further clarify any section of these documents as needed. Amendments to this document will be published accordingly in a timely fashion so as not to impact preparations for the events.
TIEBREAKER CALCULATIONS (YOUR PACK METHODS MAY VARY)

1. Based on the Elapsed Time scoring system, there should be minimum need for tiebreakers. However, if needed to break a tie, we will conduct a one HEAT run-off between tied cars.

2. If using a Points Scoring system (this section is included for Packs that do), at the end of all scheduled HEATS, should there be more than one PWD CAR that accumulates the same number of points based on the sum of all points accumulated, the Race Software will automatically apply Tiebreaker calculations as follows:
   a. Results Against Common Opponents - The PWD CAR having the better results against common opponents will win this tiebreaker. Each of the tied racer’s total points against their common opponents is compared. For this rule to be applied, the number of common opponents needs to be greater than or equal to the number of track lanes, for fairness. IF THIS DOES NOT BREAK THE TIE:
   b. Strength of Schedule - The PWD CAR having stiffer competition will win this tiebreaker. Total points for each tied racer’s opponents are compared. This tiebreaker will not work if every racer races every other racer in that group. IF THIS DOES NOT BREAK THE TIE:
   c. Total Time - By using a timer, the PWD CAR having the lowest total time will win this tiebreaker. Times for each heat are recorded as well as the number of points awarded. If times for any one heat are missing (e.g. timer malfunction) then this tiebreaker will not be applied.

RULES REGARDING SITUATIONS WHERE SOMETHING CAN (AND OFTEN DOES) GOES WRONG

First and foremost – we ask for your patience in such circumstances.

The following conditions will result in a given HEAT being re-run (examples, non-exhaustive list):

- Timer or Race Software not reset and ready to process race results at the time the HEAT begins.
- One or more cars are staged and then raced in the incorrect lanes, as scheduled by the RACE SOFTWARE.
- OBSERVED interference with the performance of one or more cars due to any objects on the TRACK that were not seen and removed prior to the running of the HEAT, or thrown on the TRACK during a HEAT.
- One or more cars touch, collide, rub, or otherwise interfere with other cars during the HEAT. Typically this happens as a result of a wheel coming off, or some other part detaching from the PWD CAR and interfering with another car.
- If the car that interferes does not require extensive repair, the HEAT will be rerun immediately.
- If the car requires extensive repair, that HEAT will be rerun in rotation with the rest of the HEATS. Repairs will take place under the observation of the RACE PIT CREW.
The following conditions will NOT result in a given HEAT being re-run (examples, non-exhaustive list):

- A car fails to reach the end of the Track during a HEAT, and does NOT interfere with any other cars. The Race Software has the ability to calculate a HEAT where a PWD CAR does not finish (DNF). All DNF situations are accounted for within the scoring system.

- A car loses parts or pieces during a HEAT, but does NOT interfere with any other PWD CARS. Repairs will take place under the observation of the RACE PITS CREW.

- A car is run BACKWARDS as a result of Design issues that prevent proper, FAIR staging of the PWD CAR for each HEAT.

NOTICE OF VERBAL CONSENT TO BE PHOTOGRAPHED / VIDEOTAPE

REGISTERING A PWD CAR FOR PINewood DERBY EVENTS CONSTITUTES YOUR VERBAL CONSENT TO BE RECORDER, PHOTOGRAPHED, VIDEOTAPE, OR OTHERWISE DOCUMENTED FOR THE PURPOSE OF PROMOTING THE EVENTS AND RECOGNIZING THE SCOUTS’ ACHIEVEMENTS.

Sometimes we take photographs of Scouts either at Pack Events or when they are involved in organized outdoors activities. We may use the pictures in Council or District publications or on our website. We may also make video recordings as part of our effort to record the event and to promote Scouting. To comply with the Data Protection Act 1998, we need your permission to photograph or make any recordings of your child. Occasionally, TRCBSA may be visited by the news media (usually local newspapers) to take photographs or film of an event... Scouts will often appear in these images, which will be published in local newspapers or even broadcast on television. The Data Protection Act is not relevant if there are parents who express a wish to take photographs or make a video recording of a particular event for their own personal use. Parents are not permitted, however, to take photographs or to make a video recording for any purpose other than their own personal use (e.g. with a view to selling videos of a Scouting event). Recording and/or photographing other than for private use would require the consent of the other parents whose children may be captured on film. Without this consent the parents concerned would be in breach of the Data Protection Act.
WHAT DO I DO ON RACE DAY?

REGISTRATION
Scouts entering PWD Cars for Registration will proceed to the Check In Area, where they will submit their Participant Permission Form. Each Scout will receive his Registration Slip. The Scout will be identified on his Registration Slip.

PWD CAR IDENTIFICATION
A sticker will be affixed to the Derby car, for the purpose of identifying the car within the correct DIVISION in which it will be racing. You can have other numbers on your PWD CAR as decorations, but only the official Racing Number will be recognized as the identifier for the PWD CAR. Do not move or remove the Sticker once it has been placed on your PWD CAR.

PHYSICAL DIMENSIONS
Scouts will then progress to the Physical Inspection Station, where the physical dimensions of the Pinewood Derby Car will be by means of a dimensions checker gauge, pictured at right. The length, width, height, and front nose contact sections will be checked for compliance with the Official Rules. The underside clearance will also be checked.

CONSTRUCTION MATERIALS INSPECTION
Scouts will then progress to Construction Inspection Station, where the visual inspection of their Derby Car takes place. All of the regulations, specs, and specific areas discussed within this document are going to be inspected at this Station. The Derby Cars will be checked for any liquid lubrication and/or leaking substances, loose parts, inappropriate construction, wet paint, wheel weight, and any other rules violations.
FINAL WEIGH IN AND CHECK IN

Scouts will then progress to FINAL INSPECTION STATION, where their PWD CAR will be weighed. There will be ONE OFFICIAL EVENT SCALE used for the event, calibrated to weigh the entire PWD CAR in ounces (accurate to two decimal places - 5.00 ounces). NO ONE other than Race Officials shall come in contact with the ONE OFFICIAL EVENT SCALE. The OPTIMAL RACING WEIGHT is 5.00 Ounces. If the PWD CAR weighs 5.01 Ounces or more, the Entrant will be asked to take their car to the pit area to adjust their weight. If the PWD CAR weight is BELOW 5.00 Ounces, the Entrant will be given the option of running the car “as-is” OR adjust their weight up to the OPTIMAL RACING WEIGHT.

IMPOUND AREA

Cleared PWD CARS will be moved from the Inspection Area into the IMPOUND AREA. Apply Lubrication and final adjustments PRIOR to starting the Registration Process. NO CONTACT with PWD CARS will be permitted once they are cleared for competition as a result of the passing the final station. At NO TIME should anyone other than a RACE OFFICIAL or PIT CREW member enter or be in the impound area.

VOLUNTEERS NEEDED!!!

Pinewood Derby is the result of many different people doing many different things. Ultimately, the success of the event is dependent upon the performance of the volunteers involved. Each Pack sends a minimum of 2 staffers to cover the entire event. Packs sending less than 5 Cubs need send only one volunteer. Each Pack may send more if they want to break into shifts. Here are some of the opportunities available for those who wish to contribute to the success of our event!

► Pit Crew
► Dimension Checker
► Construction Checker
► Registration
► Race Spotters
► Car Runners
HOW DO I BUILD A DERBY CAR?

A few important things to remember:
1. The boys and adults should make the cars together as a project! It is not the intent that the parents show the Scout the garage door then walk away; nor is it the intent that the boys play video games while the adults cut and sand. Parents should shape with the power tools and then direct the rest of the action while showing the boy each step in building a car.
2. Have fun! After all, this is what it is all about.
3. Know the rules. Being disqualified can be very embarrassing.
4. Safety first. Let’s not lose any fingers!
5. This Section of the Event Guide is deliberately longer than necessary to convey the rules in order to provide as much information to inexperienced builders.

BUYING A 100% PREMADE FINISHED CAR OFF THE INTERNET OR OTHER SOURCE:

It is highly recommended that you resist the temptation to purchase a prebuilt “speed car” off of the internet. The vast majority of these cars do NOT adhere to the rules set forth in this document, and you will have spent your money in vain.

THE “CORE” OF YOUR CAR:

- The PRIMARY CORE of a PWD CAR is defined as that portion of the car that actually transfers the weight of the entry to the axles, wheels, and track surface.
- The PRIMARY CORE of your PWD entry MUST conform to the specifications of the materials found in an officially licensed BSA Pinewood Derby product, and Construction must have begun during the current school year.
- The finished PWD entry must use AT LEAST: 1 pinewood block, 4 OFFICIAL BSA Pinewood Derby Axles, and 4 OFFICIAL BSA Pinewood Derby Wheels.
- No loose or moving parts. Details, such as doors, a steering wheel, or driver must be secured during the actual races.
- No slip weights or liquid weights.
Examples of precut bodies
NOTE: some non-BSA wheels pictured and not approved for BSA events.

Additional decorative materials CAN be attached to the PRIMARY CORE, so long as the overall dimensions conform to the Race Rules.

- If you have limited woodworking resources, and your unit does not offer construction workshops, you can purchase from a variety of sources a pinewood block that has been pre-shaped for you. If you choose this option, and intend to have your entry judged for a design award, be prepared that such a car will be at a serious disadvantage as compared to other entrants.
- Cars will not be accepted with wet paint.
- The ENTIRE car, including decorative add-ons, MUST fit into an inspection box which measures at 7” x 2-3/4”. The car must be able to travel freely under the finish gate which is approximately 3 inches above the track surface, and must roll freely on at least 3 wheels without binding on the center guide strip 1 3/4” wide and 3/8” high when rolled on a level plane surface.
- Axles must be placed in the pre-cut axle slots provided in the block of wood (wheelbase cannot be changed).
- Any concerns regarding clearances will be tested on the actual track to insure your PWD CAR will perform properly.

Item: 16990
Adjustment Tool

“Designed exclusively for Supply and adjusting a Pinewood achieve maximum performance. tool itself measures 7 3/4” x 3 5/8”. adjustments to a car and each are screen printed in black on adjustments are defined in the

WARNING: Choking hazard. years

CLICK HERE TO SEE

Pinewood Derby® Car
Retail Price: $5.49
Group, this is a new tool for aligning Derby® car during construction to The tool is made of clear acrylic. The The tool is used for seven different of the adjustment reference numbers the face of the tool. The seven instructions included with the tool.”
Small parts. Not for children under 3

MORE INFO
DESIGNING A NARROW FRONT CAR This can result in a HUGE competitive disadvantage due the way finish line sensors operate. Finish line sensors register your completed run when they are approximately 66% occluded. Look at this photo. The car on the left has clearly won the race, but might possibly register second or even third. You should design a full width front wing if you are planning a narrow car. This will help to eliminate this potential design flaw. If you are asked to correct for this condition, consider this an opportunity to avoid having a great car that does not record its finishing order correctly.

HIGH NOSE DESIGN - IT IS HIGHLY RECOMMENDED that you design your car so that the front of your car contacts the starting pin 3/4" from the track surface or lower. When starting gates were not spring loaded, a high nose design could have given you an extra advantage by allowing the car to roll sooner than if it touched the starting pin at a lower spot. Modern spring loaded starting gates for the most part eliminate this advantage, but the design shown to the right COULD exhibit the same characteristics as a narrow nose design by not registering correctly at the finish line.

ALL portions of the PWD entry must be BEHIND the starting pin to be approved for racing.

Pinewood Derby Event Staff could require that your car be modified and/or run backwards if is found to be difficult to accurately stage by the starter, OR of there is a concern that the nose design could result in similar finish line errors to those described above. Pinewood Derby Event Staff will not rerun heats unless there is interference between two cars or cars are found to have been staged in the incorrect lanes for that Heat. If you are given the opportunity to adjust the front of your car, and you choose not to do so, be advised that there are no appeals of Heat Results.
AXLES, AXLES, AXLES

SOURCE FOR AXLES

Regardless of where you purchase your AXLES for your PWD Entry (note that axles are already included in the basic kit), they must have begun life as OFFICIAL AXLES from BSA PWD KITS. This translates into a prohibition on AXLES created to appear similar to official axles, or are manufactured from a different raw material and shaped to conform to the dimensions of official BSA NAILS/AXLES. No chromed or nickel-plated axles permitted. Axles cannot be grooved, or notched.

This is not to say that you cannot purchase prepped AXLES – quite the opposite: AXLES that are de-burred, smoothed, and polished ARE PERMITTED. Several vendors sell pre-polished axles which began life as OFFICIAL BSA axles. These are approved for use, dramatically simplify construction of your PWD entry, and generally make life easier for builders.

Here is one example of a 3rd party vendor’s Axles:
4097 Official BSA Speed Axles (4) (Prepped)

Shaft Diameter: 0.0860 inch ± 0.003 (BSA: 0.0870 ± 0.003)

Shaft Length: 1 inch (same as BSA)

Material: Zinc-coated steel (same as BSA)

http://www.maximum-velocity.com/officialbsaspeedaxles.htm
AXLE LOCATIONS – As stated earlier, axles must be placed in the pre-cut axle slots provided in the block of wood.

CANTING OF AXLES – At least 3 wheels must make contact with the track during racing and inspection with the treads parallel to the track surface. Canting of axles to approximate “razor wheels”, by reducing the contact patch to one edge of the wheel, is expressly prohibited by these rules. Race Officials will be inspecting all cars and all cars will be subject to approval.

LUBRICATION – Some types of lubricants may foul the track for optimal racing performance of other PWD cars. In order to avoid this and to promote a level playing field, liquid lubrication cannot be used. Further, silicone lubricants with a “dry surface” result is similarly banned. It is recommended that dry lubricants such as graphite or powdered Teflon “white lube” be utilized. Any last-second lubrication to be applied by Scouts must be done prior to inspection. BE ADVISED that your PWD entry will be inspected on race day to insure that no banned lubricants have been applied. The inspection team has the right to apply dry lubricants to any PWD entry and spin its wheels. If a banned lubricant had been applied, it is likely that the mixture of lubricants would greatly inhibit performance.

Dry White Teflon with cling / Tube-O- Lube / Hob- E-LUBE

Camie #888 Silicone Release Agent & Lubricant / Krytox 100 0.25 oz / NyOil II 2.0 oz Bottle
WHEELS GO ROUND AND ROUND

VERY IMPORTANT INFORMATION REGARDING WHEELS FOR THE PINewood DERBY:

**MAJOR CHANGES** had been made (starting in 2010) to the manufacturing processes of the Official Pinewood Derby Car Wheels (beyond the new colors). The new STANDARD wheel has significant performance advantages over previously manufactured wheels. As a result of the introduction of these wheels to the market, we wished to address them here. **2012 ADDENDUM** – It will be unlikely that the older wheel styles will be present during events, but this information is included to insure that we cover any potential situations from last year.

What follows is a reprint of a Feature Article on the subject, as originally published (well over a year ago) at http://www.maximum-velocity.com/:

**New Cub Scout Pinewood Derby Wheels**- If you follow pinewood derby racing, then you will have heard rumors that BSA is changing the wheels in their Cub Scout Grand Prix Pinewood Derby kit. These rumors started many months ago with an occasional sighting of these reclusive wheels. But in recent weeks, the wheels have become widely available, at least in the replacement wheel packs.

Today, we will take a look at the new wheels, and compare them with the previous wheels. Also, for race leaders we’ll discuss how these new wheels will affect your race.

**New Wheel Specifications**- Regardless of the rationale by BSA for creating new wheels (likely cost), the mold designers stayed true to the older design, and did a truly nice job on the molds. The new wheels look very much like the older wheels, but (so far) tend to be more accurate than their predecessors.

**Outside** - From the outside, the only obvious differences are the slight font change on the raised lettering, the change from the trademark insignia (TM) to the registered trademark insignia (R), and the addition of a recessed ring in the outer hub. This recessed ring is likely counterproductive to performance, as it will change the contact point with a beveled axle head, resulting in more braking torque.

**Inside** - The changes on the inside of the wheel are more apparent. In addition to the font change for the raised lettering, the inner hub is reduced in diameter and coned, and the tread is slightly thinner. These latter changes result in a wheel with less weight (better performance).

**Tread Surface**- Yes, the mold mark on the tread surface is gone. This is welcome news as less work is needed to prepare a wheel, and the wheels tend to run truer out of the box.
Photo comparison of Old and New Wheel

COMPARISON OF NEW WHEELS WITH OLD WHEELS - So, how do the new wheels compare with the old wheels? The basic measurements are shown in the following table. But in summary, the new wheels are lighter, smaller in diameter, and generally more accurate.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Old</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Diameter</td>
<td>1.193</td>
<td>1.184</td>
</tr>
<tr>
<td>Tread Thickness</td>
<td>0.09</td>
<td>0.068</td>
</tr>
<tr>
<td>Hub Diameter</td>
<td>0.272</td>
<td>0.227</td>
</tr>
<tr>
<td>Bore Diameter</td>
<td>0.096</td>
<td>0.096</td>
</tr>
<tr>
<td>Overall Width</td>
<td>0.438</td>
<td>0.427</td>
</tr>
<tr>
<td>Weight (grams)</td>
<td>3.6</td>
<td>2.7</td>
</tr>
</tbody>
</table>

All measurements (except weight) are in inches, and are typical numbers.
WHEEL MANUFACTURING MOLD COMPARISON - Are there differences in the various molds that produce the wheels? Yes, there is variation, but not as substantial as with the old wheels. The table below gives a comparison of the sixteen mold number.

Notes on measurements:

1. Measurements made in August of 2009. Ten wheels from each mold were randomly selected from 2,000 wheels. The wheels were examined and the results averaged.

2. In general, all of the wheels are good - much better than the previous wheel version. The difference between the Excellent, Good, and Okay ratings is a few thousandths of an inch.

3. The bore size on all mold numbers measured within one thousandth of an inch.

FOR RACE LEADERS - Race leaders need to be aware that these wheels will affect your race in several ways.

RULES - Many Packs use rules that are very specific as to the treatment that can be applied to wheels. One common rule is a minimum diameter of 1.180. Given that the new wheels are typically 1.184 in OD out of the box, even a tiny amount of tread sanding/polishing will reduce the diameter to less than 1.180. So this minimum diameter number should be reduced to (for example) 1.170 to accommodate the new wheels.

Some Packs regulate wheel weight. Obviously, the lower weighted wheel will require a change to the minimum wheel weight.
Finally, some Packs do not allow the inner hub to be coned. Since the new wheels come coned out of the box, this rule will need to be changed.

**CAR PERFORMANCE** - As of this writing [remember, this is an old article!], the pinewood derby kits are generally shipping with the older wheels, while replacement sets are generally shipping with the new wheels, so it is very likely that some cars will be entered in your race with the old wheels, and others with the new wheels. Due to the better accuracy and the lower wheel weight, out of the box the new wheels will generally outperform the older wheels. Therefore, if both wheel types are allowed in the same race, the cars with the newer wheels will have an advantage.

So, a decision must be made at the appropriate level (Pack, District, or Council) as to whether to require the old wheels, the newer wheels, or run a two-class race (or ignore the issue and let the chips fall where they may). As a side note, if you are entering a car in a race that allows the new wheels, then you certainly want to use them. [Shelter Rock District is ignoring this issue as we expect all kits to be shipped with the new wheels by the time the cars are made]

**SUMMARY** - Change is inevitable, and the transition is not always smooth. The new wheels will require a carefully thought out transition during the coming season. If you are involved in running a race, make sure to consider how you will accommodate the new wheels. If you are racing a car then make sure to know the local rules regarding the new wheels, and then use them if you can.

1. There is also a rumor that the axle nails are changing, the difference being that the new axles are shorter. However, in all of the new sets we have received, the axles are unchanged. So, if and when we see an axle change, we will let you know the specifics.

2. To resolve this issue, DerbyWorx is removing the recessed ring on their machined wheels.

3. The mold mark on the tread is replaced with three small mold marks on the inside of the wheel. These can be seen in the photo showing the inside of the wheel.

4. Please be aware that old and new wheels can be found mixed in a tube of replacement wheels and will likely be mixed in the kits as well.

www.maximum-velocity.com

Photos and articles from the Maximum Velocity web site are used by permission. We thank Maximum Velocity for their cooperation in developing this document, and their contributions to Pinewood Derby.
WHEELS RULES 2013

Wheel Diameter - cannot be reduced past the ridge (rippled) edge, which must remain intact on the entire wheel.
Wheel weight - cannot be reduced below 2.5 grams each.
Hub Coning – allowed (on new wheels the coning has largely been done).
OUTSIDE Contact Patch / Tread - CANNOT be modified or altered to a profile that is concave, grooved, H-Shaped, angled, or otherwise out of parallel with the bore of the wheel.
Contact with Track - at least THREE Wheels must make contact with the track.

©Copyright 2009 - Maximum Velocity, Inc.
www.maximum-velocity.com
<table>
<thead>
<tr>
<th>2013 CONSTRUCTION CHART</th>
<th>BSA DIVISIONS WEBELOS I, BEARS, WOLVES, &amp; TIGERS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRE-CUT UNFINISHED PINewood DERBY CAR BODIES</strong></td>
<td>APPROVED, but beware of potential lower scorings in design categories</td>
</tr>
<tr>
<td>“BSA OFFICIAL KIT” WHEELS (new or old style both permitted, but new style is HIGHLY recommended)</td>
<td>REQUIRED – no less than 2.5 grams each</td>
</tr>
<tr>
<td>BUYING PINEBLOCK SEPARATELY AND CHANGING THE STANDARD WHEELBASE AND AXLE SLOTS FROM THE “BSA OFFICIAL KIT”</td>
<td>NOT APPROVED</td>
</tr>
<tr>
<td>OVERALL DIMENSIONS OF PWD ENTRY</td>
<td>7” LENGTH, 2 ¾ “ WIDTH, 3” HIGH FROM BOTTOM OF WHEELS 3/8” UNDERSIDE CLEARANCE</td>
</tr>
<tr>
<td>BUYING PREPPED AXLES THAT BEGAN LIFE AS THE STANDARD “BSA OFFICIAL AXLES” FROM KIT</td>
<td>APPROVED</td>
</tr>
<tr>
<td>POLISHING SHAFTS AND REMOVAL OF MOLD MARKINGS ON “BSA OFFICIAL AXLES” FROM KIT</td>
<td>APPROVED / RECOMMENDED</td>
</tr>
<tr>
<td>NOTCHING BODY AT WHEEL LOCATIONS TO IMPROVE TRACKING PERFORMANCE.</td>
<td>APPROVED / RECOMMENDED</td>
</tr>
<tr>
<td>HIGH NOSE DESIGN OR NARROW NOSE DESIGN</td>
<td>YOU RISK BEING REQUIRED TO RUN BACKWARDS</td>
</tr>
<tr>
<td>GROOVED AXLES OR WHEEL BORES</td>
<td>NOT APPROVED</td>
</tr>
<tr>
<td>WASHERS, BUSHINGS, BEARINGS, INSERTS, SLEEVES, GRAPHITE PADS</td>
<td>NOT APPROVED</td>
</tr>
<tr>
<td>MOTORS, MAGNETS, SPRINGS, SLIP WEIGHTS, MOVING PARTS, SUSPENSION OF ANY KIND, LIQUID WEIGHTS, ROCKETS, GASOLINE, PLASMA ENGINES, CO2</td>
<td>NOT APPROVED</td>
</tr>
<tr>
<td>REUSING LAST YEAR’S CAR</td>
<td>NOT APPROVED</td>
</tr>
<tr>
<td>LIQUID LUBRICANTS</td>
<td>NOT APPROVED</td>
</tr>
</tbody>
</table>
WHAT CAN I DO TO MAKE MY WHEELS BETTER?

Pinewood derby wheels are made by an injection molding process that leaves undesirable blemishes and imperfections in the parts. Since the wheels are the only moving parts, their quality has a significant effect on performance.

**FORMER BSA car wheels are pressed from 18 different molds, each with slightly different characteristics (NEW STYLE WHEELS CURRENTLY CONFIRMED FROM 16 DIFFERENT MOLDS).** The wheels are split up and packed into boxes randomly, but the best performance results are often obtained from wheels from the same select mold. ON PRE-2009 WHEELS, Die molds 2, 4, 7 and 8 generally produce wheels with superior speed characteristics. 3, 8, 12, 15 were found to have superior performance characteristics among the NEW STYLE WHEELS. Wheels from these molds number are typically defect free, more round, and have a large wheel bore size. See chart on page 20.

Out of round wheels can be corrected by **lathing or shaving**. Some wheels have a particularly bad wobble that can set up vibrations even when the wheels are lathed, balanced and run on polished axles. If you suspect that you have such a wheel, it may be advisable to discard it and use a wheel from a different kit. Note that a particular mold number does not assure a particular performance characteristic due to run-to-run variation within that mold. Always test your wheels and discard those that perform poorly no matter what the mold. The simplest wheel treatment is sanding. Here, the wheel is held in a mandrel and inserted in the chuck of a drill or drill press. **Sandpaper** is used to dress the wheel tread surface to remove the **sprue gate trim** and leave the outer surface of the wheel flat. Lighter wheels are advantageous because a large fraction of the kinetic energy of the car is contained in the rotational energy of the wheel. Light wheels mean less rotational energy in the wheels and therefore more linear speed. True wheels mean less wobble and straight tracking. You want the wheel to remain in the middle of the axle and have the minimum contact with the car body and axle head. Hub CONING is the process of modification of the inside wheel hub to reduce hub-to-body contact area and thereby the friction. Although the hub should not ride on the body, it will make intermittent contact as the car moves down the track. The hub can be coned using a lathe, a rotary tool or drill press with a grinder bit, or a special hub tool for pinewood derby wheels.
WHAT CAN I DO TO MAKE MY AXLES BETTER?  

(HOW TO POLISH YOUR AXLES)

AS ORIGINALLY PUBLISHED BY PINewood DERBY VENDOR:

http://www.abc-pinewood-derby.com/axle-polish-instructions.htm

1. Inspect your axes for flaws. Replace defective axes.

2. Check that your axes are straight by either rolling them on a flat surface or spinning them in a drill.

3. Carefully remove the burr on the head of the axle and crimp marks on the axle shaft.

4. Cut three 8” by 1” strips from an old t-shirt or other light cloth.

5. Spread a very thin layer of the Step 1 polish on a 4” center section of one of the cloth strips.

6. Mount an axle in a drill or vice or hold it with a pliers (drill is preferred).

7. Hold each end of the cloth strip and place the center of the strip under the axle shaft using moderate pressure. If using a drill, spin the axle while slowly moving the cloth about one inch over a 10 second period.

9. If using a vice or pliers, move the cloth back and forth 1” for 15 seconds. Turn the axle 90 deg. and repeat until all sides of the axle are polished.

10. If done right, there should be a dark residue on the cloth.

11. Using the same method, take one of the clean cloth strips and clean the axle of any excess polish.

12. Repeat steps 6 – 11 for the other axes.

13. Repeat steps 5 – 12 for the Final Step Polish.
WHAT CAN I DO TO MAKE MY DERBY CAR FASTER?

**NOTCHING THE BODY** In **Diagram A** to the right, there is shown a typical car and track cross-sectional end view. The body is 1-3/4" wide and as shown evenly straddles the 1-5/8" wide guide strip. Of course, in an actual race, the car may move some either to the right or to the left. The difference between the body width and the guide strip is 1/8" total or 1/16" on each side when centered. So, when the wheels are pushed against the body by hand like in **Diagram A**, to form the minimal separation between the wheels tread insides and the track, on each side there is more than 1/16" because each wheel hub protrudes an additional 0.040" more than the tread and the hub is the part that contacts the body. So the net clearance between the wheels treads and guide strip is 0.1025" on each side when centered.

**Consider Diagram B** - A common “play” distance that keeps the wheel from being **pinched between the body and the axle head** is about 0.050", roughly the thickness of a stack of 5 playing cards. So when the wheels are running at maximum separation against the inside of the axle heads, the clearance has grown to 0.1525" on each side.

**Case C** shows the situation which is the common sense interpretation of the 1-3/4" width rule. Namely, the car must pass inspection for at least a 1-3/4" separation by seeing if it will roll over freely (no binding) by clearing the length of a 1-3/4" wide rectangular slab (the slab could be 3/8" high to check the height clearance rule simultaneously).

In **Case C**, we show as an example about the smallest practical clearance as 0.005" on each side between the wheels and test strip. But notice to be able to take advantage of the 1-3/4" width rule with wheels at maximum separation (against axle heads), the wheels would be partly inside the 1-3/4" body. Nevertheless, as can be seen by the guide strip dashed outline, there would still be plenty of clearance, (1/16"+), between the wheels and guide strip. Therefore, one will find many builders that will “notch” the body, or use a narrower body as shown by the vertical dashed lines or a really narrow body with wooden dowel spar extensions to hold the axle nails.

© The Physics of the Pinewood Derby 2004-All Rights Reserved
© pinewoodderbyphysics.com 2009 Rights Reserved
WHERE CAN I LEARN MORE ABOUT BUILDING A GREAT DERBY CAR?

[Links provided without warranty, endorsement, or expectation of performance. Providing these links and the content herein does not constitute an assurance that the techniques, materials, and products advertised are approved for use on any Pack, District or Council level events. Please consult the official rules contained in this document to guide your design process. Any products, techniques, or services shown on sites linked from this page that are prohibited by the official rules should still be considered prohibited even though a link has been provided. All content provided on these sites are without influence or control by the Theodore Roosevelt Council, Shelter Rock District, or any individuals operating these events. No warranty implied. No guarantee for the continued existence of these sites, these links, or the content provided. ***]
CONDUCT OF SCOUTS & THEIR GUESTS

(pertains to all Scouts, parents, siblings, staff & guests)

Please remember that we are guests at the event site. The following basic courtesies are to be observed during the District Pinewood Derby event. Thank you in advance for your cooperation.

1) All Scouts are to be in full Class A uniform and show respect for property and people they encounter while at the mall.

2) Running, pushing, playing in the elevator & escalators, and other kinds of horseplay will not be tolerated.

3) Siblings are the responsibility of the parent and should follow the same guidelines as the Scouts in uniform.

4) Scouts and siblings should not roam the mall or go into stores unattended.

5) Remember the code of Good Sportsmanship (first page of this booklet). Don’t be a sore loser or a sore winner (this rule also applies to parents!). This event is meant to be fun even though it is a competition. All participants are winners.

6) Parents and/or adult guests of participants should set the example of sportsmanship and Scout-like conduct for their sons, other Scouts & families, and the public – at all times.

7) Only cheering is allowed from the 2nd story of the mall above the race. Vulgarity, name-calling, cat-calling, rudeness and unsportsmanlike conduct are not. Neither is communicating with staff members on how to “run” the race or their son’s car (i.e. calling from above that the car is being run backwards and needs to be turned around. Comments/suggestions such as these, if needed, should be made “face-to-face” and not from 50’ above).

In order to ensure that everyone has a safe and enjoyable time, Scouts or any of their guests that continue to break the above rules will be disqualified from the event and will be escorted from the area.